TROPICAL AGRICULTURE

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TROPICAL AGRICULTURE is published at the Imperial College of Tropical Agriculture, St. Augustine, Trinidad, West Indies, at the end of the third week of the month preceding the one of issue. Advertisement rates can be obtained at the College from the Editor, or from the Secretary of the College, 14, Trinity Square, London, E.C. 3, England. The Editor will be glad to consider authoritative articles for publication. It is understood that opinions expressed in signed articles are those of the author and do not necessarily represent the policy or opinion of the College Authorities. Increasing numbers of inquiries are being received from various parts of the tropics which can be answered only by persons possessed of an intimate knowledge of local conditions. Enquirers should first satisfy themselves that their local Department of Agriculture is not able to supply them with the desired information before communicating with us. Correspondence which will be replied to is invited on all other matters pertaining to tropical agriculture, science and development.

RESEARCH AND PRACTICE.

In a recent issue of *The Times* there appeared an article on "Science and Farm Practice" which deserves the careful consideration of everyone engaged in tropical agricultural research and practice. It is emphasized that progress must inevitably be slow and the accruing results uncertain unless the two great forces in agriculture operate in harmony, and are mutually helpful. Agriculturists should appreciate the intricate nature of the work that engrosses and perplexes the scientists, but it is equally essential that the difficulties of putting their teaching into practice should be recognised by the men of science. Neither side has a monopoly of the serious obstacles to progress and if the best results are to be secured both must advance towards a common meeting place where their respective difficulties can be explained and discussed from the different aspects. It is recognised that the attitude of agriculturists towards science and those engaged in it has improved, and it is certain that the average agriculturist now manifests greater respect for science than he did in the past. This improved relationship equally reflects a change in the bearing of scientists. As the result of increased experience each side has learned to appreciate more fully the difficulties of the other.

The research worker needs the sympathy and indulgence of others besides the practical agriculturist. The enlightened agriculturist indeed appreciates the obscure and involved character of the problems engaging attention in the laboratory, and recognizes that results may not be forthcoming quickly. He knows that there is no short-cut to the solution of the problems which can be tackled on the land, and those to be investigated in the laboratory are known to be at least equally intricate and delicate. It is not, therefore, in this quarter that impatience is expressed with the rate of progress of work which scientists have in hand. On the contrary the agriculturist's main complaint lies in the hasty pronouncement of results. It has too frequently happened that results issued by centres of research have failed to justify themselves in field practice. Even one failure of this kind tends to shake confidence in science and it is of the utmost importance that in the future the greatest care should be exercised in eliminating as far as possible the issue of such imperfect results. The leading centres of research have been fully cognizant of the detrimental effect on scientific investigation whcih results from the

publication of incompleted studies, and it is largely to this that the increased respect of agriculture is due.

The premature publication of results has not always been the fault of the investigators. The chief culprits, it is alleged, have been the authorities under whose auspices the investigations or field trials have been carried out. To them must be attributed a liberal share of blame for the barrier which has separated scientific worker and practical agriculturist. Public bodies are usually impatient for results and do not invariably realise the time required to probe unsolved problems thoroughly and draw from the information revealed deductions that will yield definite and reliable results in the field. The enlightened planter usually has a sincere sympathy, born of his own experience, with the scientist hustled for results. *The Times* correspondent refers to one "discovery" whose failure in practice was estimated by scientists engaged in the same class of work to have thrown back the teaching of research work twenty years.

The clamour for immediate results has resulted in the neglect of some of the more fundamental problems of wide application, and, ultimately, of the greatest commercial importance, for which extended investigation is essential. It is for problems of this nature that institutions such as this College are best adapted. Where necessary work could be continued over a long period by relays of research workers and problems could be approached simultaneously from various aspects and the results correlated and brought to bear upon the main issue. But for the performance of such work an adequate staff and ample land are essential. At present the demands upon the College in various capacities are increasing more rapidly than its resources. The issue is quite clear. With adequate financial backing the demands can be met; without it they cannot. Without an estate where investigations can be made and tried out on a commercial scale, and without the staff necessary for this work some restriction in the activities of the institution cannot be avoided. The more immediate functions are expanding so rapidly that the more fundamental research work, for which the constitution of the College is peculiarly well adapted, will, in all probability, suffer most. That such should prove the case would be most unfortunate. The remedy, however, lies not with the College but with others.

CANE CRUSHING MACHINERY.

THIS well illustrated Catalogue (No. S.10), issued by Mirrlees Watson Co., Ltd., of Glasgow, gives sizes and general specifications of Cane Crushers, Mills, Gearings and Engines. It, incidentally, contains an illustration of the complete 11-Roller 16-inch by 21-inch Milling plant presented by this firm to the Imperial College of Tropical Agriculture.

A separate Pamphlet (No. S.11) gives the special features of extra heavy duty cane Mills. This pamphlet is also issued in Spanish (No. S.11A).

CHEMOTROPISM IN THE COTTON PLANT.

By PROF. F. HARDY.

IT has been known for some time that the moist layer on the under surface of the leaves, and on the buds and young shoots of the cotton plant, is markedly alkaline in reaction (pH. 8.5, or thereabouts), whereas the tissue fluid, as is the case with the great majority of plants, is acidic (pH. 5.2 to 5.5). This implies that some sort of alkaline substance is exuded by the plant and dissolves in the dew. (*See* C. M. Smith, *J. Ag. Res.*, 1923, 26, p. 192; J. E. Mills, *Science*, Sept. 19, 1924, p. 268, and Harris, Hoffman and Johnson, *ibid.*, Jan., 16, 1925, p. 65). These observations have suggested that a soluble volatile base, probably belonging to the alkyl amines, is produced and liberated by the cotton plant, and, further, that this substance may be, at least in part, responsible for the specific attraction which the cotton plant exerts towards certain of its insect pests, in particular, the cotton boll weevil, which annually demands high toll in the cotton fields of America.

The importance of these facts and suggestions do not need stressing. Obviously, if the exact identity of the chemotropic substance of the cotton plant could be established, the substance may be synthesised or otherwise obtained in sufficient quantity to permit its use as a bait for trapping those insect pests of the cotton plant that react specifically to its influence. Hence great economic significance attaches itself to any attempts to identify the odorous volatile component of the cotton plant.

Perhaps the first attempt to isolate the volatile component was made in 1918 by Viehoever, Chernoff and Johns (*J. Ag., Res.* 1918, 13, p. 345). The material used consisted chiefly of cotton seedlings grown at Tallulah, Louisiana, U.S.A. About 1820 kg. of fresh plant material were distilled, and from the distillate, some 29 g. of a brown essential oil were extracted by the use of ether. The oil was found to contain no furfural, and the higher boiling fractions were observed to possess a blue colour; otherwise, none if its characters nor components was further determined.

Recently, another and more elaborate effort has been made to isolate and to identify the odorous component of the cotton plant, by F. B. Power and V. K. Chestnut at the Phytochemical Laboratory of the Bureau of Chemistry of the United States Department of Agriculture. This work was undertaken at the request of Dr. L. O. Howard, Chief of the United States Bureau of Entomology, and its results are fully described in the *Journal of the American Chemical Society*, June, 1925, 47, 6, p. 1751, from which the following summary is abstracted.

A ten-acre field of Upland cotton at Tallulah was set aside for the investigation. The plants were 60 to 200 cm. high at the time of reaping, during July and August, 1923. Only foliage,

squares, flowers and small bolls were distilled, and their combined mass amounted to some 3,290 kg. The distillate (5,300 litres), was a slightly turbid liquid containing some globules of colourless oil floating on the surface. It possessed a characteristic persistent and rather pleasant odour, although the first portions were somewhat pungent. Part of the distillate, after concentration by cohobation, was extracted with ether. The essential oil thus isolated represented approximately 0.0031 per cent. of the mass of original green material. It was a pale, yellowish, limpid liquid, which darkened in colour on exposure to air. Its odour was agreeable and persistent. An aldehyde and furfural were definitely identified in it.

The concentrated distillate, which represented all the odorous and volatile components of the young cotton plants, was found to contain the following substances. (1) methyl alcohol in large amount, and traces of actone; (2) amyl alcohol and certain of its higher homologues, in small quantity; (3) acetaldehyde, and traces of a higher aldelyde; (4) vanillin, in small amount; (5) a trace of a phenol; (6) an optically inactive dicyclic sesquiterpene; (7) a new optically active tricyclic sesquiterpene; (8) a paraffin hydrocarbon (probably triacontane); (9) a blue oil, probably containing the highly unsaturated hydrocarbon, azulene; (10) formic, acetic and caproic acids, possibly in combination as esters with previously mentioned alcohols; (11) ammonia; (12) trimethylamine. The two last were present in considerable amounts in the distillate, ammonia predominating. Doubtless, these are the soluble bases which confer a marked alkaline reaction on the dew that collects on the plant surface, as was mentioned at the outset. Both ammonia and trimethylamine were also found to comprise the emanations that come from the living cotton plant. Trimethylamine has been proved by field tests to possess some attraction for the cotton boll weevil, but further experiments have yet to be undertaken in order to determine definitely whether or no it can be employed as an artificial trapping bait.

It may be noted that the emanation of ammonia and trimethylamine from the cotton plant is probably due to the well-known interaction between fixed alkali carbonate and an ammonium salt and choline respectively. The alkali may be secreted in special glanular hairs that cover the under epidermis of the leaves. The ammonium salts and choline doubtless occur in the tissue fluids, and may be exuded at the leaf surface, where they come into contact with the alkali. Choline has definitely been identified in the cotton seed, and is very widely distributed in plants, since it is a constituent of the phosphatide, lecithin, which is a component of all living cells. (Onslow, *Pract. Plant Biochemistry*, 1923, p. 171.) Numerous plants, other than cotton, spontaneously evolve ammonia and trimethylamine. Thus certain species of *Chenopodium* are characterised by this property, and in consequence, possess a very strong fetid odour, due to trimethylamine chiefly. Alkali carbonates, furthermore, have been identified in greater or lesser quantity in the liquid secretations of many plants, for example, the scarlet runner bean (*Phaseolus multiflorus*), Ochra (*Hibiscus esculentus*), and other members of the family Malvaceae, including cotton.

Finally, Clifford and Fargher (*J. Textile Inst.*, 1923, 14, p. 117) have isolated both ammonia and trimethylamine from cotton fibre by distillation with caustic soda under pressure, this result further suggesting that ammonium salts and choline occur in the content of cotton bolls, as well as in the superficial tissues of the bolls, and in the tissues of other green parts of the plant.

TROPICAL AFRICA.

IN a recent address to the Cambridge Branch of the Royal Colonial Institute, Sir Frederick Lugard spoke on the Progress Development of Tropical Africa. The progress of commerce lies largely in the hands of the merchants, but the Government can give help through the Agricultural Departments with trained men such as it is the intention of the Imperial College of Tropical Agriculture to turn out. The reports of Mr. Ormsby-Gore bring out the comparatively recent increase in prosperity and this is reflected in the material well-being of the native populations. Furthermore Government revenues have increased and rendered possible the efficient administration of medical, sanitary and educational reforms which have brought about some measure of intellectual and moral progress. Contact with commercial civilisation has tended to break up native society and it is doubtful whether alien conceptions of justice and administration can replace the old tribal discipline. The guidance of these virile races, not without natural intelligence, is perhaps the greatest problem of the 20th century. Past experience shows that education confined to a few in the towns produces a class alien from their people and having the sole aim of imitating the white man. Recently the Committee on African Education has formulated a policy which seeks to get the African to understand that tribal and village leadership, and efficiency in the work in which their fathers spent their lives, are worthy objects of ambition. The teaching is based not on foreign models but on native tradition and native mentality. Education is not limited to the class-room; the primitive communities must be taught how to establish their own native courts for the disposal of minor offences and disputes and this is the task of the District Officer, the back-bone of the administration. Where people live their own life dominated by their old superstitions, while outwardly conforming with the inexplicable commands of the white man, there is no stability and withdrawal of alien control would cause the best ordered state to lapse quickly into its old condition unless education on the above lines took place. For this work the very best men are required and there are few careers which afford such opportunities for personal initiative.

QUEENSLAND SUGAR INDUSTRY.

By H. T. Easterby,
Director of Sugar Experiment Stations, Queensland.

The Queensland sugar fields stretch along the North-Eastern coast of Australia, from the New South Wales border as far as Mossman in the Cape York Peninsula. Thousands of acres of growing cane can be seen along the main North Coast line from Brisbane to Cairns, particularly North of Mackay. The total acreage under cane is about 300,000 acres.

In all there are 36 Sugar Mills operating, the latest addition being the magnificent Government Mill at the Tully River. This fine district has now been opened up and a large settlement, with schools, bank, stores, picture shows, &c., has been created, where only four years ago a dense tropical scrub existed. The cost of a new Sugar Mill such as the Tully is between half and three-quarters of a million pounds, to erect and equip with tramlines.

The tonnage of sugar produced in 1925 in Queensland was 485,585 tons, the acreage under cane then being in the vicinity of 268,000 acres, of which the cane growing upon 189,000 acres was crushed. Each Mill has tramways radiating to the various farms for the transport of cane to the Mill, and the Mills are connected by rail to the nearest seaport.

It is estimated that the value of Queensland's sugar crop to be crushed this year will be some nine million pounds.

This Industry employs 28,000 men in the fields, and some 7,000 in Mills and Refineries.

Trains and steamers are employed in carrying thousands of tons of raw sugar to the Refineries in the South, and bringing back freight, such as farm implements, boots, jam, tinned foods, clothing, &c., to supply the requirements of the great army of sugar producers and wage earners.

The sugar industry is a combination of agriculture and manufacture, and as such is probably the best market for machinery implements and stores of all descriptions, most of which are manufactured by Australian firms.

No other agricultural industry in Australia employs so much manual labour.

This distribution of wealth, but for the Sugar Industry, would have gone to foreign countries, which take little or nothing in the way of exports from this country.

The wages paid for labour in the Queensland Sugar Industry amount to £6,000,000 per annum. The number of farmers growing sugar cane is 7,000.

The State Government naturally take a very keen interest in Queensland's great Sugar Industry, and the price paid for sugar is the outcome of negotiations by the State with the Federal Government. In order to protect farmers, the Regulation of Sugar Cane Prices Acts was passed, and the grower now has a voice in the fixing of the price for his product. Another result of the care given by the Government to the Industry is the great reduction (nearly two tons) in the average weight of cane required to make one ton of sugar. This is largely due to the introduction of better varieties of cane, more careful cultivation, better Mill work, and organised instruction. The Bureau of Sugar Experiment Stations of the Department of Agriculture makes investigation into cultivation, soils, fertilisers, and gives instruction and lectures to cane farmers. In addition, research work into Entomological and Pathological problems is carried out. The Government also own some of the Mills in Queensland, and take every opportunity of promoting the welfare of the industry. The wages of labour are fixed by a State Institution termed the Board of Trade.

The largest Sugar producing centre is the Mackay district, which manufactured 87,000 tons of sugar in 1925, and this is followed very closely by such districts as Innisfail, Babinda and Cairns.

One of the most marked features of the Sugar Industry in recent years has been the great progress made by the sugar districts north of Townsville. In 1910 the Sugar Mills above Townsville only produced 57,135 tons of sugar, while in the year 1925 the production reached 215,000 tons. In 1910 there were 7 sugar Mills above Townsville and 42 below. In 1925 there were 10 sugar Mills above Townsville and 26 below. In dry years the 10 sugar Mills above Townsville will manufacture more sugar than the 26 Mills below that City.

The average yield of cane per acre in 1925, was 19.36 tons, and 2.56 tons of sugar per acre, but the yield of cane per acre, under suitable climatic conditions, frequently reaches 50 tons. The amount of cane required to make a ton of sugar in 1925 was 7.5 tons.

The most vital point about the Queensland Sugar Industry is its National importance. It was pointed out by a Royal Commission that "Unsettled areas in the tropical parts of Australia are not only a source of strategic weakness, but they constitute a positive temptation to invasion." The great part the Queensland Sugar Industry has played and is now playing, in the settlement of our Northern littoral is now fully recognised and appreciated by the Australian Government.

The Bureau of Sugar Experiment Stations is constantly introducing new varieties of cane from abroad, and has also raised many thousands of new Seedling canes at South Johnstone Experiment Station, and these are at present being commercially tested.

A scientific staff is continually employed by the Queensland Government in research work into Entomological and Pathological problems and the checking of insect pests and diseases.

The Industry is being kept up to date by better methods of cultivation, the use of tractors and improved farm machinery, and the use of fertilisers following advice given by the Bureau of Sugar Experiment Stations. The Mills are adding new machinery and their one aim is to make their plants up-to-date and efficient in every respect.

Queensland Sugar Industry.

(See page 104)

SUGAR FACTORY, SOUTH JOHNSTONE, NORTH QUEENSLAND.

TEN MONTHS PLANT SUGAR-CANE, SOUTH JOHNSTONE, NORTH QUEENSLAND.

ACADEMIC STAFF—IMPERIAL COLLEGE OF TROPICAL AGRICULTURE—SESSION 1926-27.

Standing :—Messrs. H. H. CROUCHER, R. R. FOLLETT-SMITH (Seconded), H. FOY, R. E. HUNTER, Dr. R. H. HURST, Messrs. A. L. BAKER, G. WRIGHT, P. E. TURNER (Seconded).

Sitting :—Professors E. E. CHEESMAN, W. SCOTT, C. Y. SHEPHARD, H. A. BALLOU (*Commissioner of Agriculture*), MR. G. EVANS (*Acting Principal*), Professors F. HARDY, J. S. DASH, H. R. BRITON-JONES, E. A. SEAGAR.

FORESTRY.

Imperial Conference, 1926.

THAT a special forestry sub-committee should have been set up at the opening meeting of the Imperial Conference to report on Empire Forestry matters is a hopeful sign of the recognition of the subject as one of great economic importance. Under the chairmanship of Lord Lovat, the forest policy of the Empire was examined by the Committee, whose report was accepted by the Conference delegates, who also adopted a resolution endorsing the conclusions arrived at by the committee.

The following is the text of their report :—

Forestry Sub-Committee's Report.

World's Timber Supplies in Relation to Forest Policy.

The outlook with regard to the world's supply of softwoods, which constitute about 80 per cent. of the wood used for industrial purposes, is distinctly unsatisfactory. The outlook with regard to the hardwoods of temperate countries is also unsatisfactory, but it will no doubt be possible to supplement the supply to some extent by having recourse to tropical hardwoods. There are, however, difficulties of various kinds in the way of replacement of temperate by tropical hardwoods. (*See* Appendix I.)

Apart from the question of the availability of supplies of softwoods and hardwoods in sufficient quantities to meet demands, there are very important internal questions, both social and economic, which point to the necessity of all countries maintaining and extending, where possible, their existing forest areas under a system of management based on sustained production of timber.

The Sub-Committee believe that there are few subjects concerning the general well-being of individual parts of the Empire, and of the Empire as a whole, which require more earnest consideration by statesmen than this subject of the rational use and development of forests.

The Empire Forestry Conference to be held in Australia and New Zealand in 1928.

The Sub-Committee have considered and commend for approval the preliminary arrangements for the work of the Empire Forestry Conference to be held in Australia and New Zealand in 1928. The arrangements are set out in Appendix II to this Report. They have also made suggestions, which the Standing Committee on Empire Forestry will take up, as to the specialists who should be delegated to attend the Conference in order to render it thoroughly effective. They desire to urge the importance of every part of the Empire making adequate preparations for the Forestry Conference and being suitably represented.

Empire Settlement.

The Sub-Committee consider that there is a distinct possibility of developing schemes of settlement in connection with State Forestry and afforestation, or of developing adequate afforestation schemes in existing agricultural areas. The experience gained by the Forestry Commissioners in Great Britain should be of use in this connection. The Sub-Committee are in agreement with the views expressed in the memorandum on the subject of State Forestry in relation to Land Settlement which forms Appendix III to this Report, and have communicated it to the Sub-Committee of the Imperial Conference on Overseas Settlement.

Imperial Forestry Bureau.

The Sub-Committee are of opinion that there is a useful purpose to be served by an Imperial Forestry Bureau to act as a clearing-house for information; and that the matter in all its aspects should be referred to the Empire Forestry Conference, 1928, for consideration and report.

Forest Products Research.

Since the first Empire Forestry Conference of 1920 considerable progress has been made in the number and capacity of the organisations for Forest Products Research in the Empire (*See* Appendix IV), but there appears to be much need for further work and for co-operation between the various organisations. This subject will receive special consideration at the Empire Forestry Conference of 1928.

Imperial Forestry Institute.

The Sub-Committee are impressed by the useful work which has already been done at the Imperial Forestry Institute at Oxford (*See* Appendix V). They particularly desire to draw attention to the opportunities which are afforded foresters from overseas to study in and from this Institute the results of long-established scientific management in European forests.

Empire Forestry Association.

The Sub-Committee recognise the good work being done by this Association (*See* Appendix VI). which forms a useful link between the various Forest Services of the Empire and provides in its Journal a means of disseminating technical forestry information.

Proposed Resolution by the Imperial Conference.

The Forestry Sub-Committee, therefore, recommend that the Imperial Conference should adopt a resolution on the following lines :—

"The Conference, appreciating the importance of forestry to the Empire as a whole and to its constituent parts,

(*a*) Takes favourable note of recent developments of effective organisation within the Empire as exemplified by the Standing Committee on Empire Forestry, the Imperial Forestry Institute and the

Empire Forestry Association, and draws special attention to the need for co-operation in all lines of forest research;

(*b*) Welcomes the invitation of the Governments of Australia and New Zealand to hold the third Empire Forestry Conference in those Dominions in 1928, and recommends to the Governments of the various parts of the Empire active preparation for and participation in that Conference: and, further, notes with appreciation the invitation by the Government of the Union of South Africa for the Empire Forestry Conference of 1933 to be held in that Dominion;

(*c*) Refers the important question of constituting an Empire Forestry Bureau to the Empire Forestry Conference of 1928."

Signed on behalf of the Sub-Committee,

LOVAT,
Chairman.

In the above report reference is made to certain appendices. Space forbids giving these in full but a summary thereof may be of interest.

APPENDIX I

The World's Timber Position.

A review of the forestry situation throughout the world leads to the conclusion that available supplies of the principal timbers of commerce are rapidly approaching exhaustion. There is every likelihood that in less than thirty years a shortage of softwoods will be severely felt. Any limitation of supply with consequent rise in prices must have a most damaging effect on the industries of the Empire. Statistical information is far from complete but the available data disclose facts which deserve attention.

The World's Timber Requirements.

(A) SOFTWOODS.

Apart from wood used for fuel, the world demand is for softwoods—the product of pine, spruce, larch and fir.

About 80 per cent. of the saw-timber of the world is of this class. On this account it is advisable to describe briefly the forest position in the principal softwood areas.

(i) *Europe.*

Although 33 per cent. of the total land area is under forest, the consumption of softwoods exceeds growth by about 3,000 million cubic feet annually. This state of affairs is due to the enormous importation of timber into Great Britain and other West European countries where the home-grown timber supply is small in comparison to the amount utilised. Reliable statistics relating to Russia are at present unobtainable. It is well known that enormous forests of pine and spruce exist, but the great bulk of these resources cannot become available unless means of transport improve and timber commands much higher prices.

(ii) *Siberia.*

The softwood belt bordering on the Arctic Ocean is continued through Siberia to Eastern Asia. There are immense forests in Siberia but for the most part they are inaccessible. There are few rivers suitable for the floating of logs and owing to the sparsity of the population little incentive is given to railway construction. In addition, forest labour is almost unobtainable. If eventually these difficulties are overcome there is every prospect of the timber supply being diverted to Japan, China and the United States of America.

(iii) *Canada.*

The eastern half of the country has been to a great extent depleted of saw-mill timber and it is becoming increasingly difficult for the remaining forests to meet the extraordinary demands made upon them by the wood-pulp industry. According to the most recent statistics the loss from fire, insects and fungi equals the amount of timber felled each year and only 27 per cent. of the original forest is left. Three-quarters of the saw timber of the Dominion is in British Columbia, and at the present rate of consumption virgin softwood resources are not expected to last more than twenty-five years. After that the country will have to depend on second-growth forests on cut-over areas.

(iv) *United States of America.*

The original forest area of 822 million acres has been reduced to 463 million acres, of which only 137 million acres carry virgin timber. This last-mentioned area is being cleared at the rate of 5½ million acres per annum, so that, as in the case of Canada, there appears to be only about 25 years' supply, apart from the produce of second-growth areas.

The United States consumes about half of the world's lumber, and its softwood resources will soon be limited to the few western States. When this supply is finished the demand will still be there and although a reduction in consumption may take place with enhanced prices the fact remains that the British Empire will have to face the competition of this great consuming force. Already, according to official records, 83 per cent. of Canada's trade in forest products is with the United States. The amount supplied to the United States is constantly increasing, whereas the timber shipments to Great Britain from Canada have steadily declined. It is evident that when American forest resources come to an end, and, according to President Coolidge, the time is at hand when the United States will be actually confronted with a timber shortage, softwoods will be sought for from the sources which at present furnish the British Empire with its supplies.

(B) HARDWOODS.

The position is not so critical in the case of hardwoods. Not only is there less demand for this class of timber, but the forests producing it

are more abundant and more widely distributed throughout the world. Moreover, hardwoods usually regenerate themselves on cut-over areas more easily than conifers, and are much less liable to damage by fire. At the same time most of the accessible temperate hardwoods have been severely culled, while the tropical hardwoods are chiefly found in regions difficult of access and in stands so mixed with apparently worthless species that generally only a small proportion of the total crop is marketable. Tropical hardwoods, although valuable for yielding furniture woods, dye woods and timbers for special purposes, are at present of comparatively small importance as they contribute less than 3 per cent. to the world's timber consumption.

The great problem before the Empire is to decide what action should be taken in order to meet the shortage of softwood constructional timber, which in all probability will overtake the next few generations. This may in part be done by using certain hardwoods from our great tropical forests as substitutes for softwoods—a matter which requires the closest investigation.

R.C.M.

(*To be concluded.*)

CHAMBERS OF COMMERCE.

THE 11th Congress of Federation of Chambers of Commerce of the British Empire will be held in South Africa during October, 1927. At a meeting of the Trinidad Chamber of Commerce it was announced that representatives of the Associated West Indian Chambers of Commerce would submit to the Congress the following resolutions in which the College is particularly interested.

Empire Sugar Federation and Sugar Research.

Resolved :—"That this Congress places on record its wholehearted approval of the steps being taken to establish an Empire Sugar Federation which shall co-ordinate and foster both cane and beet production and other interests associated with the Empire sugar industry.

Further, it respectfully suggests that the establishment of a Sugar Research Station within the Empire should receive consideration."

Imperial College of Tropical Agriculture.

Resolved :—"That in view of the importance of scientific education and research in tropical agriculture and of the great need which existed for an Institution within the Empire where this might be undertaken on approved lines, this Congress appreciates the good work already done by the Imperial College of Tropical Agriculture situated in Trinidad, B.W.I., and commends its educational facilities to all interested in the problems connected with tropical agriculture including sugar technology."

SCIENTIFIC PUBLICATIONS.

SCIENTIFIC institutions, societies and universities, year by year pour out volume upon volume of scientific literature, and the picture of science, stifled in its own productions, is sketched by the scientific correspondent of *The Times* in calling attention to a recent pamphlet—"Organised Publication," Elliot Stock, 5s. net. All Librarians are familiar with the increasing space requirements of periodical literature, and in most of their reports will be found a request for increased library accommodation. The correspondent calculates that something like 25,000 periodical publications containing the results of research are published yearly, which when bound, would require about a mile and a half of shelf space. As the pursuit of knowledge in our civilisation may be going on in the year 2500 much as it is in 1927, a library which took all the above journals would require an additional 800 miles of shelving.

Visions are conjured up of researchers with ancillary librarians on motor cycles dashing in and out the shelves in search of references. Why not let the fancy run freer? Let research workers buy indexes only, let all libraries become specialized libraries, let recent invention play its part. The researcher rings up and gives his reference, the librarian finds it, switches on a television apparatus and stands ready for these multitudinous further references, which the keen researcher always finds necessary.

In his work Mr. Pownall has drawn up a series of proposals to ameliorate the disadvantages of accumulation—for the most part ingenious mechanical contrivances.

The Times correspondent, however, comes to the following conclusion:—"Such ameliorations would add to the cost of publication and would increase rather than decrease the total bulk of printed matter, although making its classification more easy. It would seem as if we must leave to future generations a legacy growing in bulk. But there are, too, mitigating considerations. In the first place it is more than doubtful if the paper and ink now used for most publications will survive the centuries to which Mr. Pownall looks forward. In the next place no description of objective facts is complete; it is limited and conditioned by the knowledge and requirements of the present. Almost every new generation has to scrutinize Nature afresh in the light of its own needs. The very small proportion of description of permanent value will doubtless be reprinted from time to time; the records of the rest may be left to the ordinary processes of decay. None the less, without looking too far ahead, contemporary workers would receive much help were contemporary publications produced in a more orderly fashion."

G. W.

The Editor requests that any subscriber who fails to receive *Tropical Agriculture* regularly should communicate with him immediately in order that the matter may be rectified.

PHOSPHATES IN CANE JUICE.

By H. B. Springer and J. G. Davies.

[*The following article, reprinted from the Transactions of the Society of Chemical Industry. (Journal of the Society of Chemical Industry, 46, 14, 1st April, 1927, pp. 143T-144T), describes an investigation carried out in the Chemical Laboratories of the Sugar Technology Department of the College, and at the Usine Ste. Madeleine, Trinidad. The authors are fourth year students of the College, and have received their technical training under Professors Scott and Hardy. The results of their work have important bearing on a fundamental problem in cane juice clarification, and should prove of considerable value to those in charge of the chemical control of cane-sugar factories.*—Ed.]

Following upon the suggestions of various workers on the chemistry of cane-sugar manufacture that the presence of adequate quantities of phosphate in sugar-cane juices is essential for efficient defecation, a modification of the Pemberton-Neumann molybdate method is described in this paper as being applicable to the chemical control of sugar factories. Particular attention has been paid to the reduction of the time required for the procedure, for it is evident that the assay of juices and other products should be capable of completion in as short a time as is consistent with a fair degree of accuracy. It has been found possible, by means of the procedure described, to obtain a reasonably accurate result in 30 minutes, whilst six determinations conducted simultaneously may be completed in the course of an hour.

H. Walker[1] has indicated that some idea of the phosphate requirements of sugar-cane soils may be obtained from the phosphate content of crusher juices, fixing as a preliminary standard 0.020 g. P_2O_5 per 100 c.c. of juice. He makes use of the uranium acetate method in his determinations, but the authors have found that, whilst perfectly concordant results are obtained by this procedure the values obtained are invariably low, even when the experiments are carried out on pure phosphate solutions of known concentration. McAllep and Bomonti[2] have fixed a standard of 0.030-0.035 g. P_2O_5 per 100 c.c. as being the minimum requisite for efficient defecation. It must be borne in mind that this figure will vary with every juice, depending on the purity and the nature of the impurities present. Bond[3] conducted a series of determinations on certain juice components, notably phosphates, but, owing to disturbing influences, he was unable to correlate the data he obtained with the laws of equilibrium. Farnell[4] studied the optimum conditions for the precipitation of calcium phosphate, considering the factors (*a*) time, (*b*) temperature, (*c*) reaction, and (*d*) initial phosphate concentration. He concluded that the amount of phosphate in cane juice affects (1) ease of clarification, (2) optimum pH for good clarification, (3) buffer action, and (4) increase in acidity on heating and settling.

The uranium acetate method.[5]

Attempts were first made to determine the concentration of phosphate in pure solution by the uranium acetate method. A solution of dipotassium phosphate (K_2HPO_4, $2H_2O$), containing 2.500 g. P_2O_5 per 100 c.c., was prepared as accurately as possible, and analysed by the Pemberton-Neumann method. An average of four results showed that the solution contained 2.460 g. P_2O_5 per 100 c.c., whilst a similar average based on the uranium method showed only 2.12 g. P_2O_5 per 100 c.c. Other determinations with the uranium method also gave low results.

Modified Pemberton-Neumann method.—The solutions required are: (*A*) Molybdate solution[6]: 250 g. of ammonium molybdate dissolved in 700 c.c. of 7% ammonia (15 c.c. are sufficient to precipitate 0.1 g. of P_2O_5 in 25-30 c.c. of solution.) (*B*) Nitric acid[6], *d* 1.21. (*C*) 0.1 *N*-Sodium hydroxide. (*D*) 0.1 *N*-Nitric acid. (*E*) Wash liquid: 1% potassium nitrate solution. The procedure is to heat a convenient quantity of cane juice just to boiling, cool, and filter through a Büchner funnel into a dry filtering flask, using Whatman No. 44 filter paper, and a slowly-running filter pump, the first 10 c.c. of filtrate being discarded. To 12.5 c.c. of solution *B* in a 400-c.c. beaker 5 c.c. of solution *A* are added. The beaker is placed in a water bath at 50° and 25 c.c. of boiled and filtered juice are added. After ten minutes the precipitate formed is washed free from acid with 1% potassium nitrate, by decantation on to a Whatman No. 44 filter paper in a Büchner funnel. The filter paper is returned to the beaker, 75 c.c. of 1% potassium nitrate, a few drops of phenolphthalein, and 25 c.c. of 0.1 *N*-Sodium hydroxide are added, the mixture is boiled with frequent stirring for one minute, the colour of phenolphthalein discharged with 0.1 *N*-Nitric acid, and the liquid titrated back to faint pink colour with 0.1 *N*-Sodium hydroxide. The phosphate content of the juice is given by: $P = (T-t)\ 0.0309/25$, where P is P_2O_5 in g. per 100 c.c., T is c.c. 0.1 *N*-Sodium hydroxide, and t is c.c. 0.1 *N*-Nitric acid.

The conditions of precipitation above outlined have been found to give a coarsely granular precipitate, which settles readily and exhibits no tendency to pass through the filter paper.

The data recorded in Table I give an indication as to the concordance and accuracy of this method as compared with the uranium acetate procedure. The additions of phosphate to the juice were made by placing the requisite volume of dipotassium phosphate solution in a 100-c.c. flask and making up to volume with juice. The added quantities of phosphate were revealed by the modified Pemberton-Neumann method, but not by the uranium acetate method.

Possible sources of inaccuracy.

(1) *Boiling and filtering raw juice before measuring.*—25 c.c. of raw juice were boiled, and the precipitate was filtered off and washed. The phosphate in the filtrate was then found to be

0.0178 g. P_2O_5 per 100 c.c., as compared with 0.0184 g. by the usual procedure (each figure is the mean of six determinations).

TABLE I.

Juice.	g. P_2O_5 per 100 c.c. juice. Modified P.-N. method.	Uranium method.
Raw A.	0.0086	0.0067
	0.0088	0.0067
	0.0089	—
Raw B.	0.0117	0.0084
	0.0121	0.0086
	0.0122	—
Raw B. 0.0180 g. P_2O_5 per 100 c.c. ..	0.0293	0.0239
	0.0290	0.0237
	0.0290	—

(2) *Presence of silicates.*—It is known that silicates resemble phosphates very closely in their reactions, and can replace phosphates to a certain extent in plants. Pure silicate solutions were found to give no precipitate under the conditions of the procedure. Bassett[6], however, mentions the probability of a silicate-phosphate complex being precipitated by the molybdate, and Treadwell[7] describes methods of separation, which are too lengthy for factory control work.

The extent of the error caused by the presence of silicates was investigated by means of determinations for phosphate on the following solutions :—(*a*) Pure phosphate solution of known concentration, to which sodium silicate had been added. (*b*) Juice clarified with milk of lime at pH 8.0, filtered, acidified with nitric acid, and known quantities of phosphate and silicate added. (*c*) Raw juice of determined phosphate content (0.0047 g. P_2O_5 per 100 c.c.), to which known quantities of phosphate and silicate had been added. The phosphate and silicate additions were so adjusted as to represent the concentrations stated to occur in an average juice. The silicate concentrations were based on figures given by Geerligs[8] for the total silica in the juice. The results of these analyses are presented in Table II.

From Table II it may be noted that high results are obtained in the presence of silicate, with pure phosphate solution, but that, in the presence of juice colloids, the results are inappreciably low with most of the concentrations of silicate used, and inappreciably high with the higher concentrations of silicate.

It may be deemed advisable in some factories to add phosphate to the raw juice, with a view of improving clarification, especially when the optimum pH for settling is too low, giving rise to excessively acidic end products. The use of this method for controlling such a stage in process can confidently be recommended.

The authors express their appreciation of the help and useful suggestions offered by Professors F. Hardy and W. Scott, and Mr. P. E. Turner, of the Imperial College of Tropical Agriculture.

TABLE II.

Solution.	Known P_2O_5 content in g. per 100 c.c.	Silicate content, g. SiO_2 per 100 c.c.	Averages of 3 determinations: g. P_2O_5 per 100 c.c.	Error.
(*a*) ..	0.030	—	0.0285	−0.0015
	0.030	2.000	0.0328	+0.0038
	0.030	—	0.0303	+0.0003
	0.030	0.070	0.0336	+0.0036
(*b*) ..	0.030	—	0.0288	−0.0012
	0.030	0.0175	0.0298	−0.0002
	0.030	0.0350	0.0299	−0.0001
	0.030	0.0525	0.0302	+0.0002
	0.030	0.0700	0.0329	+0.0029
	0.030	0.0875	0.0319	+0.0019
(*c*) ..	0.0347	—	0.0338	−0.0009
	0.0347	0.0175	0.0321	−0.0026
	0.0347	0.0350	0.0332	−0.0015
	0.0347	0.0525	0.0339	−0.0008
	0.0347	0.0700	0.0342	−0.0005
	0.0347	0.0875	0.0352	+0.0005

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IN a recent number of *Tropical Agriculture* a note appeared acknowledging the gift to the College of a Cascade Spraying Outfit from Messrs. Cooper, Pegler & Co., Ltd.

This firm of manufacturers now advise that they have put on the market a new model high pressure hand spraying outfit. The tank capacity is 22 gallons, equipped with powerful pump with large compression chamber, capable of maintaining an even discharge at a pressure of 220 lb. per square inch. The machine is said to be made of special brass alloy suitable for use with lime sulphur, and provided with an efficient agitator. It is claimed that one man working the pump and controlling the spray at the same time can maintain a pressure of 150 lb. with ease.

Inquiries should be addressed to Messrs. Cooper, Pegler & Co., Ltd., 24d-26a, Christopher St., Finsbury Square, London, E.C.2.

TROPICAL WORLD NOTES.

Java.

The tea expert of the Java Tea Expert Bureau, H. J. O. Braund, in his official annual report, has the following in reference to tea conditions in the Dutch East Indies during the past and future: Figures show a large increase in production of tea in Java when compared with the preceding year, but it should be remembered that 1926 was, owing to extreme climatic conditions, some 5,000,000 kilos below normal expectancy. After bringing this factor into our reckoning, however, the crop still shows a substantial increase, brought about by three main causes—(1) it is only reasonable to expect that money allocated in recent years to more intensive cultivation is now bearing fruit; (2) an increase in the area under Kampoeng cultivation; (3) good growing weather. Sumatra shows only a small increase, and crops from this island are developing but slowly. A careful study of quality and manufacture over the past year lends the impression that they have not always been maintained at their previous level and indications sometimes point to a consideration of quantity instead of quality. As in previous years, and with many gardens, signs of inadequate factory accommodation, and consequent hurried manufacture, have been visible at season of heavy flush.

From the point of view of the industry collectively, Java would be immeasurably better off if her crop this year were, say, 3,000,000 or 4,000,000 kilos less, if the quantity thrown out were made up of those grades, at present saleable, but for which it requires little insight to see no demand will shortly be forthcoming. It would appear that prospects for 1927 cannot be descanted upon favourably; if all producing countries go for full crops, there will undoubtedly be too much tea. Insistence on quality has frequently been heard, from none more so than from this bureau; at the present juncture its adherence in principle is more than ever called for.—(*Tea and Coffee Trade Journal*, Vol. 52, p. 396.)

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Bengal.

For the year 1925-26 the area under cinchona in Bengal, where the Government works two plantations in the district of Darjeeling, totalled 3,153 acres, showing an increase of 93 acres over the previous year's area of 3,060. The quantity of bark harvested was 538,783 lb., as against 432,553 lb. in the previous year, and the quinine factory at Mungpoo treated altogether 1,039,912 lb. of bark, which included material from Java. The amount of quinine and its by-products sold during the year totalled 42,551 lb., as against 43,143 lb. in 1924-25. There appears to be considerable difficulty in securing suitable soil for further extension of the plantations. — (*Chamber of Commerce Journal*, Vol. LIII, p. 343.)

Tanganyika.

Mr. C. Gillman recently read an interesting paper to the Royal Geographical Society on South-West Tanganyika Territory. Mr. Gillman was the Government surveyor in charge of the party trying to find a railway route into Lake Nyasa, and in that capacity had ample opportunity for making detailed observations. The area in the main consists of the south-wards-narrowing and most elevated part of the Great East African Plateau, into which the deep Nyasa Rift Valley is sunk. Towards the West side the way to Lake Nyasa is effectively barred by a range of mountains six to eight thousand feet high, with no passes that a railway could take advantage of. This barrier rules out Lake Nyasa as a means of communication with Nyasaland, while the mountains rise too steeply from the lake shores for there to be much cultivation around it. Between the mountains and the sea there is a plateau which is well watered by five rivers that are tributaries of the Kilombero river which itself runs into the Rufigi. This Kilombero plain is a vast expanse of perfectly flat alluvial land, which is a well watered grass-steppe. However, a close study of the soil is needed before a final opinion can be formed of its value as a cotton and rice producing area. There is no timber on the lower plains, but the mountains are covered with a magnificent rain forest. A European settlement of the Kenya type has been advocated, but it should be pointed out that there are important differences. First it is 10°S. which results in increased inclemency of climate, added to this there is a prevailing south-east wind which for six months of the year sweeps the eastern and central portions with a bitter, biting and continuous blast. The chief disadvantage is the evaporation from the lake which makes the relative humidity very high, and makes life at a low atmospheric pressure, nerve and heart-affecting. There is also malaria and spirillum tick.—*The Geographical Journal*, Vol. 69, p. 97.

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Upper Niger.

A Danish scientific expedition, under the leadership of Professor C. Clufsen, and supported by the Carlsberg Fund, is now on its way to Senegal to explore the upper region of the valley of the River Niger, the Upper Volta, and the southern part of the Sahara, especially Air (Asben or Agadiz). The expedition, whose main purpose is to collect objects of ethnological interest for the Danish museums, proposes to return *via* Zinder and Kano, through Nigeria, to the Guinea Coast, and thence by sea to Dakar. Professor Clufsen will be accompanied by two Danish scientists, Mr. Oluf Hagerup (botanist) and Mr. Harry Madsen (zoologist). It is of interest to know that the costs of the expedition are being defrayed by the fund for scientific research donated by the well-known Danish Lager Beer concern, the Carlsberg Brewery, Copenhagen.—(*The African World*, Vol. XCVIII, p. 479.)

British Guiana.

Some interesting reflections on the position in British Guiana are contained in a leader of the *Times* occasioned by the recent return of Mr. Roy Wilson and Mr. H. Snell from their visit to that Colony, of which we give an abstract below:

These two members, the one Conservative and the other Labour, were Commissioned by the Colonial Office to report primarily upon the steps that might be taken to make better use of the economic resources of British Guiana, and it is these trade possibilities that constitute its special claim upon public attention. A territory the size of Great Britain, it is the portion of our West Indian possession in which the greatest amount of work has still to be done, and from which the greatest results could be obtained.

The immediate prosperity of British Guiana turns upon its sugar. One day timber may be the chief source of interest, for nearly ninety per cent. of the whole territory is forest, and so far only about an eighth of that forest area is being worked. Even so despite grave difficulties of transportation owing to the lack of railways and the falls of the river—a considerable export of hard woods is carried on. In the last few years research into the possibility of obtaining supplies of paper pulp has yielded encouraging results, and the limitless market, especially in the New World, which paper pulp seems to have before it, has caused Canadians in particular to take a new and keen interest in the Colony as a field for development. The last few years have also seen fruitful experiments, in which the Government took the lead, in rubber growing, for which much of the land is evidently well suited. But sugar remains as it has always been, the staple commodity of British Guiana and the arbiter of its prosperity. The history of the Colony has been dominated by the question of labour for the sugar plantations ever since the abolition of slavery nearly a hundred years ago. The successive experiments in importing labourers peopled the country with Portuguese, with Chinamen, with Indians, and so determined the composition of its 200,000 inhabitants to-day. The longest and most important of the labour experiments, the indenture system, which brought men from the overcrowded populations in India on long contracts, made the Indians in Guiana, as in Fiji, one-half of the population, before it was finally stopped a few years ago by the action of the Government in India. The labour outlook is uncertain to-day, but for the moment the future of the main industry of Guiana is uncertain also. Sugar has come to enjoy several new advantages, but to feel some disadvantages more than before. The British preference has proved an invaluable help, particularly as competition has proved unexpectedly severe not only from Cuba and Java, which can grow it more cheaply, but from unlooked-for quarters like Czechoslovakia and, inside the Empire, from Queensland and Natal, with their large home markets. The home Empire market is too small for all the sugar-producing parts of the Empire, who must share it, and there are anomalies in the administration of preference which the Guiana sugar-growers are working to have altered, such as the granting in Great Britain of Customs drawbacks on exports containing sugar, in proportion to the duty paid. The trade also suffers from the competition of beet sugar, and the handicap of lacking large-scale capital improvements, such as have nullified drought in Java or made feasible the mass production of by-products like industrial alcohol in Queensland.

* * *

Johore.

The latest colonial report on the Unfederated Malay States under British protection, shows that during 1925 the total trade of Johore attained a value of $168,088,810, as compared with $82,162,699 in the previous year. Of this total imports accounted for $49,874,197 ($33,688,565 in 1924), and exports for $118,214,613 ($48,474,134). Under the head animals, food, drink and tobacco, imports amounted in value to $18,876,750 ($17,505,199), while articles wholly or mainly manufactured were valued at $17,961,991 ($13,021,531). Rubber was the principal commodity exported, and accounted for $97,195,046 ($30,090,966), followed by copra $6,026,179 and tin ore $3,040,020 ($2,348,888). Re-exports were valued at $498,496, compared with $354,752 in 1924. The areas under rubber and coconuts in this State during the year were 534,771 acres and 90,000 acres, respectively, and that under wet padi during the 1924-25 season approximated 5,600 acres. The production of wet padi during the season amounted to 869,000 gantangs, an increase of 50 per cent. on 1923-24. Exports of pine-apples in 1925 amounted to 652,840 cases, and 29,611,118 fruits, the land under pine-apple cultivation being estimated at 16,000 acres. It is anticipated that there will be a considerable increase in the planting of the African oil palm in the next few years in Johore, where over 2,000 acres are already devoted to its cultivation. Shipments of betel nuts fell slightly to 185,000 pikuls, but there was an increase in exports of tapioca. Sago was exported to the extent of 23,500 pikuls. The amount of tin ore shipped was 23,160 pikuls, as compared with 23,695 pikuls in 1924. The Japanese hematite iron-ore mine at Bukit Medan produced 271,992 tons of ore, as compared with 235,118 in 1924. This ore, which has a high metal content, is much in demand among smelters in Japan. The china clay industry of Johore was dormant till August, when exports on a small scale began. This industry turns out about 50,000 latex cups a month, which sell readily among local rubber producers. Of the 27,634 tons of timber produced, 17,814 tons were exported. Two samples of lac obtained in the State have been favourably reported on, and samples of lac varnish were prepared which gave excellent results when used on wood or metal. (*Chamber of Commerce Journal*, Vol. LIII, p. 343.)

EMPIRE SUGAR.

DURING the past few months, the position of Empire produced cane sugar, its improvement, its relation to home and foreign produced beet sugar, has been the subject of many interesting and informative papers.

In the *West India Committee Circular* (Vol. XLI, pp. 465-7, 485-6.) Lieut.-Col. Ivan Davson deals with the position of British Colonial Sugar. After an admirable survey of the world's sugar-producing countries, he writes about the disabilities of the British Colonies and the remedies called for. The first is an increase in the preference :—" Were the West Indies and British Guiana to receive for their raw sugar so slight an increment as 1*d.* per lb. . . . the difference to their fortunes would be remarkable." This would involve an alteration in the Customs scale of preferential duties which, he says, " is unfair in its incidence and seriously prejudices the market for Empire raw sugar." In addition he criticises the method of granting drawbacks on Empire Sugar and supports a criticism already well ventilated by the West India Committee and bodies representative of the sugar industry. The production of beet sugar in England is referred to in the following terms. "The home production is being accorded special treatment in order that it may develop. The subsidy in this case is on a diminishing scale, but it is a large one and it is urged in some quarters that the benefits which the industry will bring to the country may well justify an indefinite continuance of the subsidy as it has appeared to do in other countries."

Mr. Ben Morgan, Chairman of the British Empire Producers' Organisation, recently gave an address to the Dominions and Colonies Section of the Royal Society of Arts on "The Sugar Resources of the British Empire." (*Journal of the Royal Society of Arts*, Vol. LXXV, pp. 361-79), in which he summarised the world production, the sources of supply for the United Kingdom, the present position and prospects of various sugar producing countries within and without the Empire, and gave his opinion on the organisation essential to meet foreign competition. He considers the main points of advantage enjoyed by foreign countries are strong Government assistance, adequate scientific research and economic co-operation between all branches of the sugar industry. So far as the first is concerned, the Empire Sugar producers were, in the budget of 1925, assured a stable preference of 4*s.* 3*d.* per cwt. for a period of ten years. Although expressing gratitude for this and stating that Empire Sugar has at last received an effective preference, he compares it unfavourably with the help given in America, on the Continent, and to the English beet sugar industry. There is much to be expected from the increase in consumption which has resulted from low prices, and from reduced costs of production that would follow from organisation, improved methods of manufacture and the use of by-products. He also hopes for co-operation between producers and refiners—" The unfortunate relations between the British refiner and the Empire producer have left both of them weaker." Then follows a concise survey of sugar producing countries, particular reference being paid to those within the Empire, the comparison of standards of production being quite illuminating. In concluding Mr. Morgan expresses his view that the abnormal competition of foreign sugars induced by governmental help has in many respects destroyed the value of the encouragement given by the Imperial Government. He states, " I am convinced that if we extended to our Dominions and Colonies a preferential treatment as favourable as do our competitors to that Colonies, Great Britain would in a period less than ten years be entirely independent of foreign supplies, with consequent great agricultural development and increased employment and settlement within the Empire."

Both writers it will have been noticed refer to the special advantages enjoyed by the English beet sugar industry, and it will be recalled that the British Government gave a subsidy for four years of 19*s.* 6*d.* per cwt. on sugar produced from beets grown in the British Isles having a sugar content of 15 per cent. Three years have now passed and for the following three years the subsidy will be reduced to 13*s.*, being in turn succeeded by a subsidy of 6*s.* 6*d.* for three years. The effect of the subsidy was well shown in the debate which took place in the House of Commons on 15th and 16th February, when the increased production was favourably commented upon.

The British refiners recently issued a statement of their grievances, and it is with this that Sir Francis Watts deals in "The British Refiners' Case from a West Indian Point of View."—(*International Sugar Journal*, XXIX, pp. 138-142.)

The British refiners claim that they are an integral and essential part of the business of sugar production, employing 10,000 men and producing 900,000 tons of refined sugar out of a total consumption of 1,710,000 tons of all sugars. Their particular grievance is the subsidy to the English beet sugar industry which they think will " bolster up an industry hopeless on its merits at the expense of the refining interests." The root of the trouble is, however, that the beet factories carry straight on and produce refined sugar. The refiners urge that their interest would not have been prejudiced if the subsidies had been confined to raw beet sugar which would then have had to pass through the refineries. They also claim that they are placed at a disadvantage by the admission to the markets of the United Kingdom of refined sugar and sugar fit for direct consumption produced in the Dominions and Colonies. Two remedies are suggested. One that the duty on imported refined sugars be increased by 1*s.* per cwt., and that on raw sugar reduced by a similar amount, the difference between British and Foreign sugar still being maintained.

The second, that refiners in the United Kingdom be granted a subsidy of 1*s.* 4*d.* per cwt. on all the sugar they produce.

Sir Francis Watts states that the beet subsidies affect the Dominions and the Colonies in the same way but that their position, unlike that of the refiners, would not be altered by a limitation of the subsidy to raw beet sugars. He points out that the claim of the refiner to occupy a definite and necessary place in sugar production is not absolute; from the inception of the sugar industry Colonial producers have endeavoured to turn out some portion of their sugar in a state fit for direct consumption without the intervention of the refiner. On the other hand he argues that the extinction of the refiner would be inimical to the interests of the Colonial producer who must rely on him for the means of disposing of the greater part of his raw sugar. Summarising the general situation, Sir Francis says "It would appear that dumping of subsidised sugars, whether raw or refined and whether British or Foreign, constitutes probably the greatest danger confronting the refiners and Colonial producers. This is a matter which should have the most serious consideration; it is one in which it should be possible for British refiners and producers to join hands for mutual support." The first remedy suggested by the refiners meets with his approval "provided that unrefined sugars fit for direct consumption be not thereby excluded, and provided that steps be taken to prevent dumping of either raw or refined sugars from any country whatever." So far as the English beet sugar situation is concerned "there seems little that the refiners and Colonial producers can do beyond making clear to the public the extent and the unfairness of the competition thus created. . . The situation affords further proof . . . of the truth that the British public have never thoroughly understood the problems of the sugar industry, nor do they appear to grasp the extent and importance of that industry and its place in the national economy."

A '*Note and Comment*' in the same journal complains that Sir Francis "seems rather predisposed to assume that the refiners' case—against home grown beet in particular—is justified up to the hilt and that nothing remains to be done but to find a solution that will at the same time leave West Indian interests unaffected." It is stated that any completely equitable solution of the problem is decidedly difficult to effect.

The writer of the note seems quite open minded with regard to the English beet sugar question and is concerned with the political as well as the economic aspect of the question; the inception of the industry he ascribes to political necessity based on recent history, the evolution he regards as satisfactory, and the future as quite bright. To use his own words "the war impressed on us the politico-economic lesson that . . . production entirely overseas of our total sugar consumption was not good for the consumer, so steps were rightly taken to remedy that defect, and sugar beet cultivation was added to our system of agriculture. . . Thanks to the subsidy, the new experiment has been having a fair trial, has caught on amongst all progressive farmers, and while it is not yet a foregone conclusion that it will ultimately be able to exist without fiscal aid, the outlook after only three seasons is hopeful rather than the reverse and justifies the attempt being persevered with."

Out of place from the point of view of documentation, some comments of Mr. Amery, as chairman of the meeting addressed by Mr. Ben Morgan form a useful conclusion to the articles mentioned above, reflecting, as they do, the opinion of a member of the Government. He saw no reason why the whole of the sugar consumed in this country should not come from within the Empire, and he thought a substantial portion would come from the English beet industry, with immense benefit to British agriculture, and without serious prejudice to the cane-growing industry in the rest of the Empire. To increase Empire production and bring this about two conditions were required, the first being co-operation within the Empire and the second a national and imperial policy on the question. It must be their business in future years to extend the measure of preference still further and make it still more effective. The remission of the whole duty was one ideal with which he personally agreed, but he thought he was stating it without sufficient regard to the position that the Chancellor of the Exchequer found himself in at the moment. In view of the recent advocacy of stable prices in *Tropical Agriculture* it is interesting to note that Mr. Amery thought that Mr. Morgan was substantially right when he said that an assured moderate price, based on steady production and on safe sources of supply, was more in the interests of the consumer and of the manufacturer than occasional bursts of artificial cheapness, the object of which was to put the industry into the hands of those who naturally meant to raise the price at the first opportunity. Over a long period of years, a steady price within our own control was, he believed, far better than being at the mercy of any body of foreign producers.

From the economist's point of view the sugar question is decidedly difficult of solution. There are two main competing sources of the raw material, the one widely distributed in the temperate and the other in the tropical and sub-tropical zones. Within these areas the methods, standards, and costs of production are widely variant. Almost every source of supply receives some measure of official help, and almost every market has some tariff wall, sometimes for purely fiscal reasons, but more often for political reasons. A statistical problem of some magnitude is raised and until there exists some organisation for tackling the problem thoroughly and offering unbiassed and evidenced recommendations, it would probably be best to assure by adequate preferential treatment a continuous market for reasonably efficient sources of Empire cane sugar.

G. W.

INSECT CONTROL IN HAWAII.

(*Continued.*)

The Mediterranean Fruit Fly.

The foregoing remarks only refer to pests which have been, or are being, largely controlled by means of imported natural enemies. There are, on the other hand, certain other pests over whose activities economic control has not yet been achieved to a satisfactory degree.. The most important of these pests is the Mediterranean fruit fly, *Ceratitis capitata*. This insect was discovered in the islands in 1910 and had probably made its entry a year or two previously from Australia. Various attempts at control were made, including insecticidal treatment, but without success. A great abundance and variety of the host fruits, over 70 kinds being found in the vicinity of Honolulu alone, and the fact that some flourish at all seasons of the year was the main cause of the failure of the efforts made. In 1912 Prof. F. Silvestri was engaged by the Hawaiian Board of Commissioners of Agriculture and Forestry to search for fruit fly parasites. Silvestri mainly concentrated his observations in Africa but also visited Australia. He arrived at Honolulu in May, 1913, with five species of African parasites and one species from Australia. This work resulted in the effective colonisation of two species, viz.: the Braconids *Opius humilis* Silv. from S. Africa and *Diachasma tryoni* Cam. from Australia. In 1914 the Territorial Government commissioned D. T. Fullaway and J. C. Bridwell to visit West Africa in order to endeavour to obtain other parasites. The result of their efforts was that the Braconid *Diachasma fullawayi* Silv. and the Chalcid *Tetrastichus giffardianus* Silv. were successfully established. All the four above mentioned species are now widely distributed through the Islands but the net result of their activities is insufficient to give the required degree of control. It is noteworthy, however, that before the parasites commenced their activities it was almost impossible to obtain guavas free from larvae of the fruit fly, but now it is only a small minority that are infested. The same results have not been achieved with regard to many other fruits and this circumstance appears mainly to be due to two factors. Firstly, the *Ceratitis* larvae occur in many fruits which have a thick pulp which prevents their being reached by the parasites already destroying the larvae occurring in thin-pulped fruits. Secondly the four introduced parasites are to a considerable extent competing against one another. Thus, when *Opius humilis* occurs in the same host larva as any one of the other three species of parasite, it is invariably killed. At first *O. humilis* was the most effective of the four enemies but, during the past nine years, its parasitism has steadily fallen from 31 per cent. in 1915 to 4.1 per cent. in 1923, while the other species have fluctuated in value very considerably. The total combined parasitism of the four species, however, has remained around the region of 43 per cent. to 51 per cent. during the four years ending 1923. It is evident, therefore, that although the above-mentioned parasites do not at present adequately control the fruit fly in Hawaii, they have decreased the infestation to a marked degree. It remains an open question whether further adjustment will take place in the inter-relations of the parasites, to the extent of raising the sum total of the infestation, or whether efforts should be made to introduce other parasites. The view has been expressed that if the biology of these parasites had been thoroughly studied, prior to liberation, their mutual relations would have been disclosed and *O. humilis* only would have been liberated. It is claimed in some quarters that this single species of parasite would have proved a more efficient agency than the combined activities of four different species as at present.

The Australian Fern Weevil.

Perkins mentions that the Fern Weevil, *Syagrius fulvitarsis* Pasc., was first observed in 1900 in fernhouses in Honolulu on maiden-hair ferns only. At that time the possibility of its spreading to the tree ferns of the indigenous forests was not anticipated. In the years that followed it noticeably increased in abundance and, extending its range, has more recently attacked the native fern forests around Kilauea in Hawaii Island. The *Sadleria* fern has been threatened with total extinction and the destruction of this, along with other species, would involve serious consequences to water conservation owing to the shelter afforded by dense growths of fern. Early in 1921, C. E. Pemberton visited New South Wales, which was presumed to be the home of the weevil, and the insect was sparingly found in its natural habitat. The conditions prevailing in the virgin forests of that country are not unlike those obtaining in the fern forests of the Hawaiian Islands. This fact supported the conclusion that the introduction of any available natural enemies from that region into the territory of Hawaii offered a good prospect of success. While in Australia, Pemberton succeeded in discovering the Braconid, *Ischiogonus syagrii*, which was maintaining a parasitism approaching 60 per cent.—a feature which appeared to be responsible for the comparative scarcity of the *Syagrius* in its natural habitat. Two consignments of the parasites sent to Honolulu yielded 319 examples and these proved sufficient to start its colonisation in the Islands. At the present time the weevil is being very considerably checked and, although still spreading to a small extent, it is not occasioning damage to its former extent. It is a matter for speculation whether, in the event of thorough control of the weevil being maintained, the *Sadleria* will be able to reassert itself. It may be mentioned that no examples of that fern were seen when the writer, in company with Mr. Muir, spent a day in the Kilauea district and neighbouring region of the Island.—(*Annals of Applied Biology*, Vol. XIII.)

(*To be continued.*)

MYCOLOGICAL NOTES.

Extract from "A modified method of delinting cotton seed with Sulphuric Acid," by C. D. Sherbakoff. Phytopathology Vol. 17, No. 3, March, 1927, pp. 189-193.

"The experiments . . . reported show that the standard, or Duggar's method of delinting cotton seed with concentrated commercial sulphuric acid, requires ten times as much acid as is needed when the delinting is done with diluted acid by the method devised during the experiments; and that the standard method requires two and one-half times as much sulphuric acid as is necessary when the acid is added to the seed in the minimum efficient amount, which is one part to seventeen of the seed, by volume.

None of the three methods of delinting, when properly carried out, injures the germination of the seed.

Lime the seed after delinting can conveniently and safely replace washing, in any of the methods.

By testing different dilutions of sulphuric acid, the writer found that one part of concentrated sulphuric acid diluted with five parts, by volume, of water, and one part of this diluted acid added to ten parts, by volume, of cotton seed, will efficiently delint the seed if the mixing is thorough, so that the acid will be evenly distributed over the seed. But the seed must be spread in a thin layer, in a dry place, and left for about seven days. Seed thus treated with diluted sulphuric acid was kept in the laboratory for over a month, and for a few weeks in the plot barn, without any injurious effect on germination. Various other dilutions and amounts of diluted acid were also tested, but the method given was found to be entirely effective, and at the same time, most economical."

* * *

The following Abstracts of Papers presented at the eighteenth annual meeting of the American Phytopathological Society, Philadelphia, Pa., 27th December, 1926, to 1st January, 1927, are taken from "Phytopathology" Vol. 17, No. 1, January, 1927.

The corn mosaic of Hawaii distinct from sugar-cane mosaic—L. O. Kunkel.

Experiments with the corn leafhopper, *Peregrinus maidis* (Ashm.), obtained from North Carolina show that this insect is unable to transmit the virus of the sugar-cane mosaic of the United States to corn. A careful comparison made by Mr. Fred. Muir, of the Experiment Station of the Hawaiian Sugar Planters' Association, indicates that this insect is identical with the *Peregrinus maidis* of the Hawaiian Islands which transmits the virus of the mosaic disease of corn studied by the writer in Hawaii. This suggests that the destructive mosaic of corn prevalent in Hawaii is distinct from sugar-cane mosaic and from the mosaic of corn occurring in Louisiana and other Southern States.

The Fusarium Wilt of sweet potatoes on infested soils—R. F. Poole.

The Fusarium which causes sweet potato wilt may be abundant in a field, but seem not to be uniformly distributed through the soil, since some plants remain healthy in infested fields throughout the season, even though many plants are killed in July and August. This was further shown when the percentage of healthy plants was increased by using two or more plants in a hill. The plants that showed no infection, when harvested in October, were not resistant to the disease, as was shown later by testing them on infested soil. The disease did not spread from one plant to another even when heavily inoculated plants of the susceptible Porto Rico and Yellow Jersey varieties, which became diseased and died, were set one to eight inches from healthy plants of the same varieties. When the soil was artificially inoculated with a heavy suspension of spores the infection was not so severe as that resulting from immersing abscissed and cleanly removed stems in the same inoculum. A large percentage of the plants manifested symptoms of the disease in less than 14 days. Some died within 21 days, while others were not killed until late in October. Likewise, a small percentage of plants inoculated in July showed no symptoms of disease until late September.

* * *

The effect of spraying with fungicides on the keeping quality of Florida citrus fruits—Harry R. Fulton and John J. Bowman.

Florida citrus fruits are liable to losses in marketing from two types of blue-mold rot caused by *Penicillium digitatum* and by *P. italicum*, and also from two types of stem-end rot caused by *Phomopsis citri* (*Diaporthe citri* Wolf) and by *Diplodia nat lensis*. Extensive experiments for six seasons show that a single application made 15th April, and 5th May, of 3-3-50 Bordeaux mixture plus 1 per cent. oil in the form of an emulsion will reduce total rot about one-third during a prolonged marketing period. The effect is mainly on the more common Phomopsis type of stem-end rot, which is reduced more than one-half. The Diplodia stem-end rot is reduced only about one-fifth by the one application. Penicillium rots are not materially affected. This application is the one used for controlling the melanose blemish caused by the same species of Phomopsis and can be expected to give about 90 per cent. melanose control. Two spray applications in the spring control rot slightly better in the marketed fruit than one application, owing mainly to increased effectiveness against the Diplodia rot. Mid-summer and fall applications are relatively ineffective. The oil emulsion is necessary in the Bordeaux mixture and also must be used alone a few weeks later to check increase of scale insects following the destructive action of the copper fungicide on the entomogenous fungi which keep these pests in check.

H. R. BRITON-JONES.

SUGAR NOTE.

Compiled by the College Department of Sugar Technology.

Luabo Cane Sugar Factory.

This modern factory, located on the North bank of the Zambesi River in Portuguese East Atrica, was built by the Mirrlees Watson Company Limited, of Glasgow, for the Sena Sugar Estates, Limited, of London, and has recently completed its second crop. At the present time only raw sugars of 96° test are produced, but the buildings and stagings are designed to accommodate additional plant for the manufacture of plantation white sugar. A brief description of the equipment is given below since there are a number of features of interest to Sugar Engineers and Technologists.

The 14-roller mill has a nominal rated capacity of 50 tons per hour, but the crushing rate has reached as high as 75 tons per hour. The Cane is levelled in the carrier by knives, electrically driven at 400 R.P.M. The Krajewski Crusher is driven by an independent Corliss Engine 22 inches by 48 inches, and each pair of mills by an engine, also of the Corliss type, 28 inches by 54 inches. The crusher and mill rollers are all 34 inches by 72 inches.

A special feature of the Mirrlees mill is the use of a rigid type of trash-turner bar which is supported on the mill headstocks by a wide base. Vibration and "groaning" are claimed to be thereby eliminated.

Cleanliness under the mills is ensured by the use of steel trough intermediate megass conveyers, and of juice trays of a new design. These trays slope steeply towards two gutters which run across the mill bed, one under each lower roller. All pieces of broken cane ("cush-cush") are readily washed into the gutters by the flow of juice, and there can be no accumulation of fermenting solid matter in, or near, the mill beds. Nos. II and III Mills are fitted with Ramsay patented macerating scrapers which force the macerating liquid into the megass as it is expanding and before it has had the opportunity of absorbing air.

The juices from the various mills are collected by three copper gutters which deliver them to a similar number of "Jigging" strainers. These strainers consist of troughs of perforated copper plates carried by spring legs and given an oscillating motion. The "cush-cush" discharged by the strainers is elevated to a scroll conveyor which distributes it on to the carrier between Mills Nos. II and III.

Maceration water is measured by a recording water meter which indicates not only the total quantity of water used, but also the rate of flow. The juice is weighed in double tank scales fitted with a recording device for gross weights and tares.

The heating of the juice is accomplished in three stages.

The raw juice from the scales is sent through two heaters arranged in series, where it is raised to a temperature of 160°F. by vapour drawn from the second effect of the evaporator; it then passes to the liming and sulphuring tanks. From this station the limed and sulphured juice is pumped through two further tubular heaters, and its temperature raised to 196°F. by vapour from the first effect of the evaporator. The heating to 212°F. is completed in open heaters by means of exhaust steam. The juice is here cleaned by skimming before going to the subsiders.

There are nineteen first subsiders of 2,000 gallons capacity each, and a similar number of second subsiders of 1,000 gallons capacity each.

The twelve filter presses have a total filtering area of 7,296 square feet.

The Evaporator consists of five separate vessels with a total heating surface of 21,490 square feet connected to work in quadruple effect. The first effect consists of two 10-feet vessels with a combined H.S. of 7,890 square feet using exhaust steam at 2-5 lb. pressure. The second effect is a vessel of 13 feet diameter with a heating surface of 5,710 square feet. Part of the vapour from the first and second effects is used in the juice heaters. The third and fourth effects are each vessels of 11 feet in diameter.

The four Coil Vacuum Pans have a capacity of 35 tons massecuite and 1,080 square feet heating surface each. There is a liberal allowance of storage tanks for syrup and various grades of molasses. Low grade sugars can be returned to the pans through a seed mixer, or sent to melting pans.

First massecuites are discharged into strike receivers underneath the pans from which they are pumped to the distributing mixer. Low grade massecuites are discharged by means of scroll conveyors to the crystallizers, of which there are twenty-two, 23 feet long by 7 feet 6 inches diameter.

The centrifugal station consists of thirty-two 36 inches by 18 inches machines divided into four batteries of eight, each battery being driven by a 70 H.P. electric motor. The baskets are rotated at 1,000 R.P.M. by belt drive from friction pulleys mounted on a countershaft at the rear of the battery.

The Boiler house consists of five Stirling boilers of 500 H.P. each, designed for a working pressure of 150 lb. per square inch and provided with specially designed megass furnaces.

The steam used by the electric generating units is superheated in independently fire superheaters.

There are three electric generating units of 250 Kilo-Volt-Amperes each. The generators are three-phase, 60-cycle, 440-volt machines with direct coupled exciters.

All auxiliaries in the factory, such as pumps, conveyors, and centrifugals are motor driven.

The electric generator units and the vacuum pumps are located in a separate engine room, where they are free from the dust, dirt and moisture of the main factory.

The water supply is obtained from the Zambesi River.

CHEMICAL NOTES.

Compiled by the College Department of Chemistry and Soil Science.

Types of Soil Acidity.

Recent work on soil acidity has established the fact that there are various forms of soil acidity. They may be classified broadly into (A) "active" and (B) "passive." Active acidity is due to free hydrogen-ions which can be determined directly in water suspensions or extracts of the soil. Passive acidity is due to hydrogen-ions that are bound or adsorbed at the surface of the colloid component of soils. It is rendered active by treatment of the soil with a neutral salt such as potassium chloride. The excessive or long-continued use of fertilizer salts tends to activate passive soil acidity. It is possible, for example, that the acidity effects which ammonium sulphate develops in non-calcareous soils is due to this cause, rather than to the liberation of free sulphuric acid assumed in explanation according to the older theories of soil acidity.

* * *

Ripening of Pine-apples by Ethylene.

In a note published in the April number of the *Journal of the American Chemical Society*, Vol. 44, 1927, p. 1117, Messrs. Regeimbal and Harvey, of the Minnesota Agricultural Experiment Station, state that ethylene, not only aids ripening in pine-apples and improves their flavour and texture, but that it also increases the activities of the enzymes which pine-apples contain. Both the protein-splitting enzyme and the sucrose-inverting enzyme of pine-apples were affected in this way by ethylene or propylene treatment. Hence the solvent action of pine-apple juice on the mucosa of the mouth, as well as the sweet taste of the juice, are markedly enhanced by ethylene treatment.

* * *

Concentrated Orange Juice.

A few years ago, the Research Staff of the California Fruit Growers Exchange, evolved a process for preparing pure orange juice, in concentrated form. The product is made from sound fruits, carefully washed and selected. The juice is expressed and immediately evaporated in glass-enamelled vacuum pans at a temperature 98°F. The concentration reached is 7 to 1 by volume. The concentrate is run into sterilized glass jars, which are immediately closed with sterilized corks. Careful tests have shown that orange juice concentrated in this simple way retains its flavour and vitamin activity, even after storing for several months.

* * *

Humification of Organic Manures.

In the *Journal of Agricultural Science*, 1927, p. 104, Mr. G. H. G. Jones, of the University College of Bangor, Wales, describes the application of the hydrogen peroxide method of Robinson and Jones for estimating "humus," to the measurement of degree of break-down or humification of organic manures, such as pen manure. Jones found that the degree of humification in Welsh farmyard manure may vary between 75 per cent. in old, well-rotted samples, to 35 per cent. in samples containing excess of litter.

* * *

Rapidity of Action of Lime dressings.

The recent work of Dr. E. Manshard (*Z. Pflanz. Dung.*, 1926, A7, p. 31) has shown that the rate of solution of various forms of agricultural lime depends on structure as well as on degree of fineness. Thus, the coarse particles of soft chalk (0.30 to 0.75 mm. diameter) was found to be almost as soluble as the finer particles (less than 0.15 mm. diameter). This fact is attributable to the porous structure of chalk.

During the course of certain field experiments on liming heavy soils, no appreciable effect of liming on the acidity of the soil was noticed below the zone in which the dressings were incorporated, even after two years had elapsed from the time of application.

BOOKS RECEIVED.

WE have to acknowledge the receipt of the following books :—

Annotated Bibliography on the Storage of Cottonseed and of Seed Cotton. Henry M. Steece. U. S. Department of Agriculture, Washington, D.C.

Classification for Works on Pure and Applied Science. Science Museum, South Kensington.

India in 1925 and 1926. J. Coatman. Government of India Central Publication Board. Price 3*s*. 6*d*.

Cotton. H. B. Brown. McGraw Hill Book Co. Price $5.00.

Principles and Practice of Book-keeping for the Farm, Garden, Dairy and Estate. H. Taylor and J. Peet. A. Fieldhouse. Price 7*s*. 6*d*.

The Economics of Small Holdings. E. Thomas. Cambridge University Press. Price 4*s*.

Estate Accounts. C. S. Orwin and H. W. Kersey. Cambridge University Press. Price 3*s*. 6*d*.

Farm Book-keeping. H. W. Kersey. Headley Brothers. Price 3*s*. 6*d*.

Principles and Practice of Farm Book-keeping. L. Foster. Gee & Co. Price 15*s*. 9*d*.

Manual of Tree Diseases. W. H. Rankin. Macmillan. Price 14*s*.

Large and Small Holdings. H. Levy. Cambridge University Press. Price 16*s*.

Co-operation for Farmers. L. Smith Gordon, Williams & Norgate. Price 6*s*.

Introduction to Agricultural Economics. L. C. Gray. Macmillan. Price 10*s*.

Colonial West Africa. "The African World."

Co-operative Marketing of Agricultural Produce in England and Wales. Ministry of Agriculture and Fisheries. Price 1*s*. 6*d*.

An Introduction to the Study of Prices. W. T. Layton Macmillan. Price 7*s*. 6*d*.

Elements of Land Economics. R. T. Ely. Macmillan. Price 15*s*.

Soil Conditions and Plant Growth. J. Russell. Longmans Green. Price 15*s*.

REVIEWS.

THE PUNJAB PEASANT IN PROSPERITY AND DEBT, by M. L. Darling. Humphrey Milford, Oxford University Press, Warwick Square, London, E.C.4, 14s. net. pp. xxii+298. Illustrated.

In this book Mr. Darling has endeavoured to ascertain how, why, and to what extent the peasant gets into debt. Such an enquiry should be regarded as an essential preliminary to the introduction of Co-operative Credit Societies. Too often no enquiry is made either before or during the existence of Co-operative Credit Societies and such enquiry as is made is more frequently of the nature of a post mortem examination. Everyone realises the existence of the problem of peasant indebtedness, few understand, or seek to understand, its nature.

Mr. Darling finds as a result of his enquiry in the Punjab that there are four main causes of the existence of debt. The first is the small size of the peasant's holding, aggravated by excessive fragmentation, which make it impossible for him to avoid getting into debt unless he is exceptionally frugal and industrious, or possesses some extraneous source of income. The second is the constantly recurring losses of cattle from drought and disease. The third his ingrained improvidence, the effects of which are heightened by the insecurity of his crop, and the fourth his extravagant expenditure upon marriage and other domestic ceremonies.

These factors explain why the peasant must borrow. The existence of the money lender and the great expansion of credit due to high prices and the inflated value of land explain how he can borrow. It is the combination of these two factors which accounts for the great increase in the amount of debt. Too frequently borrowing is limited not by wants but by opportunities. In other words poverty explains the existence of debt and prosperity determines its extent. This view is supported by the fact that among the districts examined the most prosperous ones were those most heavily mortgaged.

One must, however, draw a distinction between productive and unproductive debt. Debt in itself is not of necessity an evil but in India expenditure is largely dictated by reasons other than economic. The solution can eventually be found in Co-operative Credit Societies, but it must clearly be borne in mind that organisations which merely increase the facilities for borrowing without ensuring that the debt is productive are worse than useless. They merely result in the borrower becoming more deeply involved than before. Mr. Darling gives us a glimpse of the work done by Co-operative Societies of different kinds in the Punjab where there now exist 10,000 Societies with a membership of a quarter of a million. He indicates that there are Societies which have not functioned successfully. That one can easily appreciate, but the reviewer hopes that the author will subsequently explain why some succeed while others do not.

This book will be widely read among Co-operative circles in India. The reviewer wishes it could be made compulsory for everyone engaged in Co-operative work throughout the tropic, to read it, since it is a notable book, remarkable not only for the information which it contains but also for the attitude of mind which it denotes.

C. Y. SHEPHARD.

* * *

PRINCIPLES AND PRACTICES OF CO-OPERATIVE MARKETING.—Mears & Tobriner. pp. 10 + 580. Ginn & Company, New York. Price $3.20.

The application of business methods to agriculture has long been up against the silent opposition of tradition, but of recent years there has been a change, costings have helped to control production and scientific marketing to secure better prices. Agricultural co-operation in the United States is largely a post-war growth and the authors give a useful descriptive and analytical account of its different exemplifications, recognising that in addition to the general problem of marketing, each commodity has its particular features. The question of organisation is important, for amongst co-operators whose interests may at times be divergent some measure of control making for continuous policy is necessary. In this connection the section on "Organisation" is very useful. The chapters on business practices are enlightening, well illustrated and well documented, although here and there fatuous things occur (the letter on page 269—pathetic, but out of place). The book is a mine of information, but the opinion must be recorded that the opening style is very tedious and will prove an obstacle to beginners, which in view of the useful nature of much that is said, it is to be hoped will be surmounted. One has the feeling that it would be twice as effective if drastically pruned. The book contains an extensive bibliography.

G. W.

* * *

INVESTIGATIONS ON OILPALMS—By Dr. A. A. L. Rutgers and others. Edited by the A.V.R.O.S., Medan. Ruygrok, Batavia. 10s. net.

This is the best general account of the oilpalm and its cultivation that has yet appeared. It presents the results of researches in Sumatra under the following heads: History of the palm in Netherlands India; Varieties; Planting; Upkeep of plantations; Artificial pollination; Estimating the age of oilpalms; Diseases and Pests; Preparation of palmoil; Threshing machines for oilpalm fruits; Packing, shipping, and selling of palmoil; Crop records of oilpalms. Numerous illustrations and a good bibliography add to the value of the work. Some of the salient features of the information herein contained have already been noted in this Journal. (Vol. I, pp. 34-39.)

E. E. C.

COLLEGE NEWS.

The Acting Principal returned from his tour round some of the Northern Islands on 7th May.

* * *

Mr. H. C. Earle-Bulwer, post-graduate student 1925-26, has been appointed Government Tobacco Adviser, Swaziland, South Africa.

* * *

Mr. Craig of the Texas Oil Co., delivered a lecture on "Lubrication Problems" on 2nd May, which was followed by a visit to the Sugar Factory.

* * *

Amongst the visitors to the College during the past month were: Mr. S. R. Drayton, Singapore; Mr. and Mrs. Hall, South Africa; Mr. M. F. Camacho, Consul for Portugal, Trinidad; Mr. N. Munro Kerr, Scotland; Mr. Morgan Davies, Mr. P. C. Davies, Mr. I. P. K. Williams, Wales; Mr. E. H. Hendrick, England.

* * *

Messrs. W. T. O. Maidment, J. C. Muir, F. A. Robb and B. T. Steemson, who were selected by the Colonial Office for the Gold Coast and sent out to the College in 1925 at expense of the Gold Coast Government, are now Assistant Superintendents of Agriculture, Gold Coast. Messrs. B. G. Owen, and I. E. James who were Colonial Agricultural Scholars, 1925-26, have both been appointed Superintendents of Agricultre, Nigeria.

* * *

At the last meeting of the Science Club, Professor Dash gave a lecture illustrated by lantern slides on "Canadian Agriculture." The next meeting, to be held on 16th June will be the last meeting of the Session and on this occasion, Sir Francis Watts will give an address entitled "West Indian Notes." This should be of great interest to those student members who have spent a session at the College and will soon be leaving for other parts of the tropical Empire.

* * *

Professor F. Hardy sails for New York on 7th June, to attend the First International Congress of Soil Science, to be held at Washington, 13th June to 22nd June, 1927. The Congress is to be followed by a three-weeks' tour of the chief agricultural regions of the United States and Western Canada. Professor Hardy is an accredited representative of British research workers in Soil Science at this Congress, and his visit should prove of considerable value to the teaching and investigation work conducted in the Department of Chemistry and Soil Science.

* * *

We are pleased to record the following appointments of students sent by the Empire Cotton Growing Corporation to receive one year of their training at the Imperial College of Tropical Agriculture:

Mr. C. B. R. King, 1922-23—*Cotton Entomologist, Nyasaland.*

Mr. N. S. Haig, 1923-24—*Agricultural Officer, Uganda.*

Mr. J. C. Hopkins, 1923-24—*Mycologist, Southern Rhodesia.*

Mr. A. B. Killick, 1923-24—*Agricultural Officer, Uganda.*

Mr. G. W. Nye, 1923-24—*Cotton Botanist, Uganda.*

Mr. J. W. Cowland, 1924-25—*Assistant Entomologist, Sudan,*

Mr. J. B. Hutchinson, 1924-25—*Junior Geneticist, Cotton Research Station, Trinidad.*

Mr. W. C. Lester-Smith, 1924-25—*Inspector of Plant Diseases, Ceylon.*

Mr. H. Marsland, 1924-25—*Inspector of Agriculture, Sudan.*

Mr. F. S. Parsons, 1924-25—*Corporation's Officer, South Africa.*

Mr. J. E. Peat, 1924-25—*Corporation's Officer, Southern Rhodesia.*

Mr. E. R. Guest, 1925-26—*Agricultural Officer, Sudan.*

Mr. J. C. Haigh, 1925-26—*Assistant Mycologist, Ceylon.*

Mr. J. V. Lochrie, 1925-26—*Corporation's Officer, Nyasaland.*

Mr. S. R. de Villiers, 1925-26—*Agricultural Officer, South Africa.*

Mr. C. F. van Rooyen, 1925-26—*Agricultural Officer, South Africa.*

Mr. F. E. Kenchington, 1925-26—*Receiving special course under Corporation's Plant Breeder, Sudan.*

PROFESSOR J. S. DASH.

CONGRATULATIONS are offered to Mr. J. S. Dash, the Professor of Agriculture at the Imperial College of Tropical Agriculture, on his new appointment. He has been offered by the Colonial Office and has accepted the post of Director of Agriculture and Science in British Guiana, which has been vacant (except of a brief period of about ten days when Mr. W. Nowell held the post) since the death of Sir John Harrison.

Mr. Dash has occupied the important position of head of the Agricultural section of the College for the last three years and has conducted the work of this branch with conspicuous ability. It is largely due to his energy and devotion that the agricultural side of the College's activities is in its present satisfactory position. The loss of Mr. Dash's services will be greatly felt at the College. His colleagues all combine in wishing him every success in his new career.

G. E.

CONTRIBUTIONS.

THE EDITOR is prepared to consider signed articles for publication in *Tropical Agriculture.* Such articles should normally vary between 1,000 to 6,000 words and may be illustrated if desired. Rates can be obtained on application to the Editor.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—The Easter holidays affected the Home market and only a small business followed. End of April quotations were London Granulated 13*s.* 9*d.*, Imitation Yellows 29*s.* 6*d.*, West Indian Crystallised 28*s.* to 31*s.* 6*d.* with a fair demand for better qualities. White Mauritius 29*s.* to 29*s.* 6*d.*, British-grown Granulated 30*s.* 9*d.* to 31*s.* 9*d.*—all duty paid. Current quotations are as follows :—Yellow Crystals 30*s.* to 34*s.* 6*d.*, Foreign *c.i.f.* 14*s.* 10½*d.* Pref. 18*s.* 6*d.* (14th May).

COTTON.—Prices show little change and the persistent steadiness of the market is its main feature. Spot demand has been small. Yarn and Cloth demand has been small and sales are far below production. The new cotton crop is becoming a more potent influence on the market. In many places wet fields and floods have delayed planting. Indications point to the fact that farmers will spend as little money as possible in raising the crop.

COCOA.—Cocoa in London is rather weaker, but the returns from America indicate that unless production be materially augmented prices generally must soon rise. Our latest quotation for Trinidad L.L.T. is 85*s.* to 87*s.* per cwt.

COFFEE.—The disappointing market of March was succeeded by an improved tone and at the end of April returns of exports showed that supply were coming forward on a scale by no means equal to the demand hence the forecast of a firm market for May. East African varieties generally have continued to sell well. Good quality coffees are becoming difficult to obtain in any quantity and in consequence all good roasting and liquoring parcels have been exceptionally well competed for.

TEA.—Average prices January to Easter were : Indian, 16.90*d.* ; Ceylon, 20.10*d.* ; Java, 11.38*d.* ; Sumatra, 13.83*d.* ; Nyasaland, 12.93*d.*

RUBBER.—After the Easter holidays, the market for Eastern Plantation Rubber opened quiet and steady but later became more active with firm prices. There have been orders both from the home trade and from the Continent. America is still taking afloat and near rubber and reports of trade there continue good. Quotations on the 21st April were as follows. Sales of Standard Ribbed Smoked Sheet on the spot and for April delivery up to 1*s.* 8*d.* Crêpe on the spot sold at 1*s.* 7⅞*d.* Delivery over the whole of next year sold at 1*s.* 10*d.*

COPRA.—The market shows a little more enquiry. The quotations on 14th May, for Trinidad stood at £27 per ton.

BANANAS.—At the end of April, Jamaicas were in good demand at £25 per ton (delivered) to wholesalers, and 1*s.* per doz. (carriage extra) to retailers. To the consumer the price was 1*d.* to 2*d.* apiece.

RUBBER IN 1926.

MESSRS. SYMINGTON & SINCLAIR, whose reports on the rubber market, along with those of other well-known firms, prove so useful in the compilation of *Trend of the Markets*, recently issued an excellent *Review of the Rubber Market for* 1926. The year 1925 saw a record price difference with a rise from 1*s.* 4⅝*d.* to 4*s.* 8*d.*, the highest price being recorded on 9th December, 1925. From that point commenced a decline which continued till early December, 1926, when business was officially recorded in Spot Smoked Sheet at 1*s.* 5⅞*d.* The cause is ascribed to the previous high prices which were followed by economy in the use of rubber and the development of reclaimed rubber.

American consumption, which, from 1919-1925 was about 70 per cent. of the world's total consumption, fell in 1926 to 67¼ per cent., whilst the amount taken was 18,000 tons less than in 1925. The consumption of other rubber using countries. however, increased so that the net decrease in world consumption for the year was only a matter of 4,000 tons. A table is given which demonstrates pretty clearly the progressive nature of the demand for rubber, and it is observed that the increase in consumption between 1919 and 1926 amounted to 213,000 tons, equal to 63 per cent. an average rate of increase of 9 per cent. per annum. The *Review* gives detailed accounts of the movements in the chief countries of production and consumption, and supplements this information by tables of comparative statistics. Special attention is devoted to the tyre and motor trade in the United States, and with regard to the latter, it is shown that although petrol consumption in 1926 was estimated at approximately 15 per cent. more than in 1925, the sales of outer covers shows a decline of over 360,000 while the sale of inner tubes fell off by nearly 8,400,000, figures which show the zest with which users entered into the "Use less rubber" campaign. One important event of the year was the formation of a "pool" by American Tyre and Motor Manufacturers for the purpose of financing a reserve supply of rubber. Messrs. Symington & Sinclair think that the organisation is not inimical to the working of restriction and the producing interests, but that it represents an effort to work in with the restriction to achieve something like stability of price for both producer and manufacturer.